VERDIGRIS BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Elk River
Water Quality Impairment: Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Elk River **County:** Elk, Greenwood and Butler

HUC 8: 11070104

HUC 11 (HUC 14s)**:** **010** (010, 020 and 030)

Drainage Area: 124.6 square miles

Main Stem Segments: WQLS: 12 and 14 (Elk River) starting at confluence with Pawpaw Creek and traveling upstream to headwaters near northwestern Elk County (**Figure 1**).

Tributary Segments: WQLS: Rock Creek (13)
Bull Creek (33)
Clear Creek (32)
South Branch Elk R. (38)
Rowe Branch Elk R. (39)

Designated Uses: Expected Aquatic Life Support, Primary Contact Recreation, Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segments 12 and 14.

Expected Aquatic Life Support, and Secondary Contact Recreation, on tributary segments 13, 33, and 32 (Rock, Bull and Clear Cr.); Expected Aquatic Life Support, Secondary Contact Recreation, Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use on tributary segments 38 (S. Br. Elk R.) and 39 (Rowe Br. Elk R.).

1998 303(d) Listing: Table 1 - Predominant Non-point Source and Point Source Impacts

Impaired Use: Expected Aquatic Life Support

Water Quality Standard: Dissolved Oxygen (DO): 5 mg/L (KAR 28-16-28e(c)(2)(A))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303(d): Not Supporting Aquatic Life

Monitoring Sites: Station 693 near Howard

Period of Record Used: 1994 and 1998 for Station 693; 2000 and 2001 Kansas Biological Survey Data (**Figure 2**)

Flow Record: Elk River at Elk Falls (USGS Station 07169800).

Long Term Flow Conditions: 10% Exceedance Flows = 290 cfs, 95% = 0.1 cfs

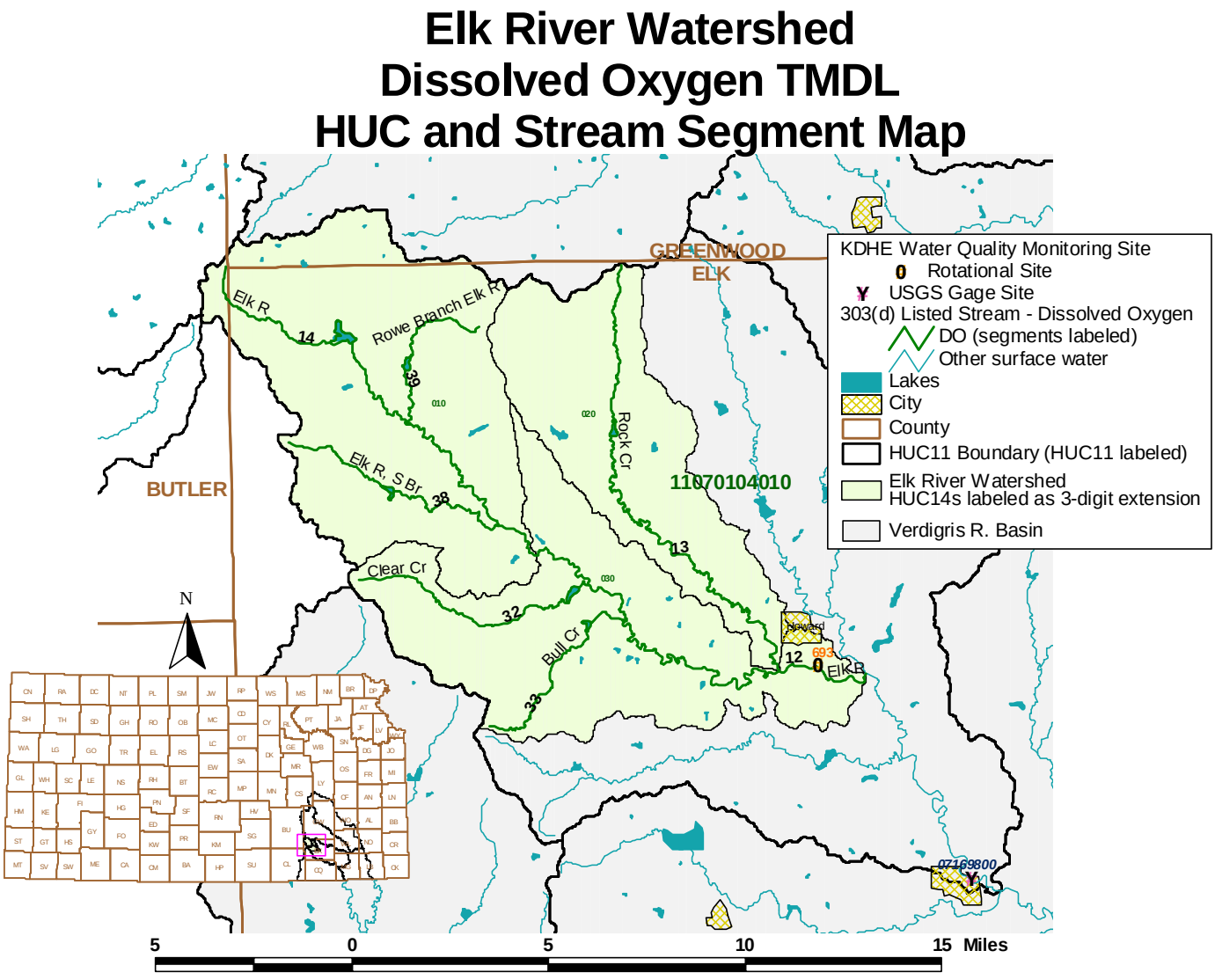

Figure 1

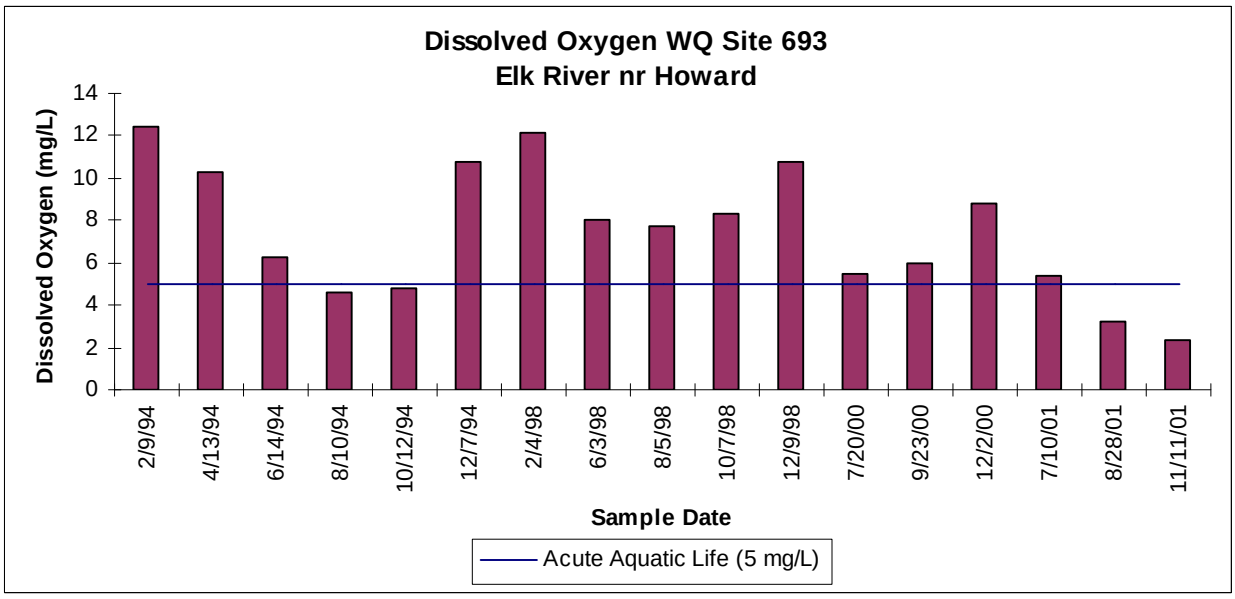

Figure 2

Current Conditions: Since loading capacity varies as a function of the flow present in the stream, this TMDL represents a continuum of desired loads over all flow conditions, rather than fixed at a single value. Sample data for the sampling site were categorized for each of the three defined seasons: Spring (Apr-Jul), Summer-Fall (Aug-Oct) and Winter (Nov-Mar). High flows and runoff equate to lower flow durations; baseflow and point source influences generally occur in the 75-99% range. Load curves were established for the Aquatic Life criterion by multiplying the flow values for the Elk River near Howard along the curve by the applicable water quality criterion and converting the units to derive a load duration curve of pounds of DO per day. This load curve graphically displays the TMDL since any point along the curve represents water quality at the standard at that flow. Historic excursions from water quality standards (WQS) are seen as plotted points *below* the load curves. Water quality standards are met for those points plotting *above* the applicable load duration curves (**Figure 3**).

Excursions were seen two of the three defined seasons and are outlined in **Table 1**. Fifty percent of the Summer-Fall samples and 17% of the Winter samples were below the aquatic life criterion. None of the Spring samples were under the aquatic life criterion. Overall, 24% of the samples were under the criterion. This would represent a baseline condition of partial-support of the impaired designated use.

Table 1
NUMBER OF SAMPLES UNDER DISSOLVED OXYGEN STANDARD OF 5 mg/L BY FLOW

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Elk River near Howard (693)	Spring	0	0	0	0	0	0	0/5 = 0%
	Summer	0	0	0	1	1	1	3/6 = 50%
	Winter	0	0	0	0	1	0	1/6 = 17%

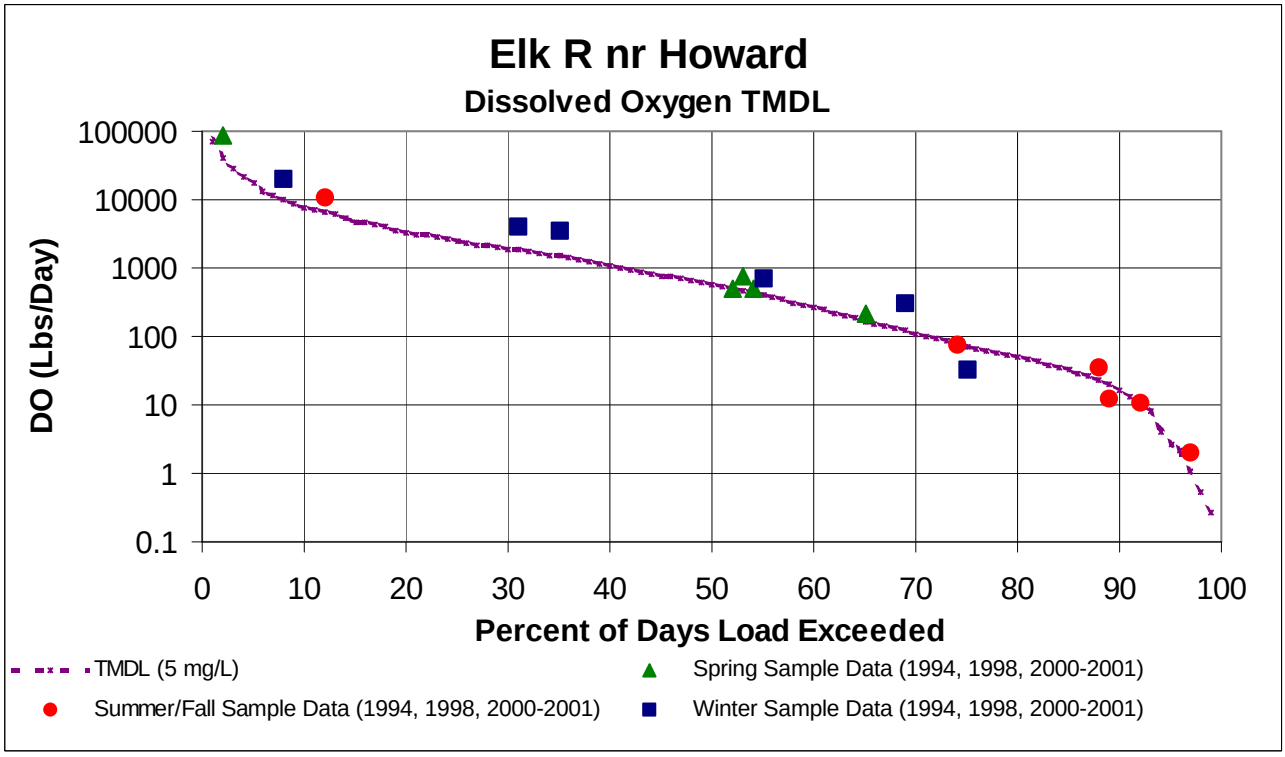

Figure 3

No DO violations have been encountered at flows exceeding 3.0 cfs on Elk River near Howard, therefore a critical low flow can be identified on the Elk River as those flows of 3.0 cfs or less.

A watershed comparison approach was taken in developing this TMDL. The Otter Creek near Climax watershed (Water Quality Sampling Site 574 in the watershed was not impaired by low DO) has similar land use characteristics (**see Table 2 in Appendix**) to the Elk River watershed, is of similar size and is located immediately north of the Elk River watershed. The relationship of DO to ammonia, biochemical oxygen demand (BOD), fecal coliform bacteria (FCB), water temperature, turbidity, nitrate, phosphorus, pH and total suspended solids (TSS) were used in the comparison.

Table 3 in the Appendix outlines those water quality data for the samples taken on the same day for the two sites of interest. **Table 4 in the Appendix** is the subset of data from Table 3 for those sample dates when DO was below the aquatic life criterion for sample site 693. From Table 4 at site 693 all comparison parameters averages were similar. Although BOD at site 693 is higher than other sites in Southeast Kansas, and the reduction of BOD should help reduce DO violations in the Elk River near Howard, it is likely that low flow is the primary factor influencing DO violations in the Elk River watershed.

Desired Endpoints of Water Quality (Implied Load Capacity) at Site 693 over 2007 - 2011

The desired endpoint will be a biochemical oxygen demand from artificial sources such that average BOD concentrations remain below 3.0 mg/l in the stream under the critical flow conditions which results in no excursions below 5 mg/l of DO detected between 2007 - 2011

attributed to these sources.

This desired endpoint should improve DO concentrations in the creek at the critical lower flows (0 - 3 cfs). Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to the low flow usually occurring in the August - November months.

This endpoint will be reached as a result of expected, though unspecified, reductions in organic loading from the various sources in the watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL (see Implementation - Section 5). Sediment control practices such as buffer strips and grassed waterways should help reduce the non-point source BOD load under higher flows which, in turn, should help reduce the oxygen demand exerted by the sediment transported to the stream that may occur during the critical flow period. Achievement of this endpoint will provide full support of the aquatic life function of the creek and attain the dissolved oxygen water quality standard.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are no permitted wastewater dischargers located within the watershed.

Livestock Waste Management Systems: Three operation are registered, certified or permitted within the watershed. These facilities (swine facilities) are located at the lower end of the watershed (**Figure 4**). All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which typically coincide with stream flows exceeded less than 1 - 5 % of the time. NPDES permits, also non-discharging, are issued for facilities with more than 1,000 animal units. None of the facilities in the watershed are of this size. Potential animal units within the watershed for all facilities is 1,280. The actual number of animal units on site is variable, but typically less than potential numbers.

Land Use: Most of the watershed is grassland (91% of the area), cropland (6%), or woodland (2%). The cropland appears to be located along the main stem of the watershed. The grazing density estimate is average for the watershed when compared to densities elsewhere in the Verdigris Basin (42-44 animal units/mi^2) (**Figure 5 or Table 2 in Appendix**).

On-Site Waste Systems: The watershed's population density is low when compared to densities across the Verdigris Basin (2 - 6 person/mi^2) (**Figure 5**). The rural population projection for Elk county through 2020 shows modest growth (10% increase). While failing on-site waste systems can contribute oxygen demanding substance loadings, their impact on the impaired segments is generally limited, given the small size of the rural population and magnitude of other sources in the watershed.

Contributing Runoff: The Elk River watershed's average soil permeability is 0.7 inches/hour according to NRCS STATSGO data base. Most of the watershed produces runoff even under relatively low (1.71"/hr) potential runoff conditions (94.7%). Under very low (1.14"/hr) potential conditions, this potential contributing area is reduced to about 76%. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the

watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.57"/hr of rain will still generate runoff from 67% of this watershed, chiefly from the upper and lower third of the watershed and along the stream channels.

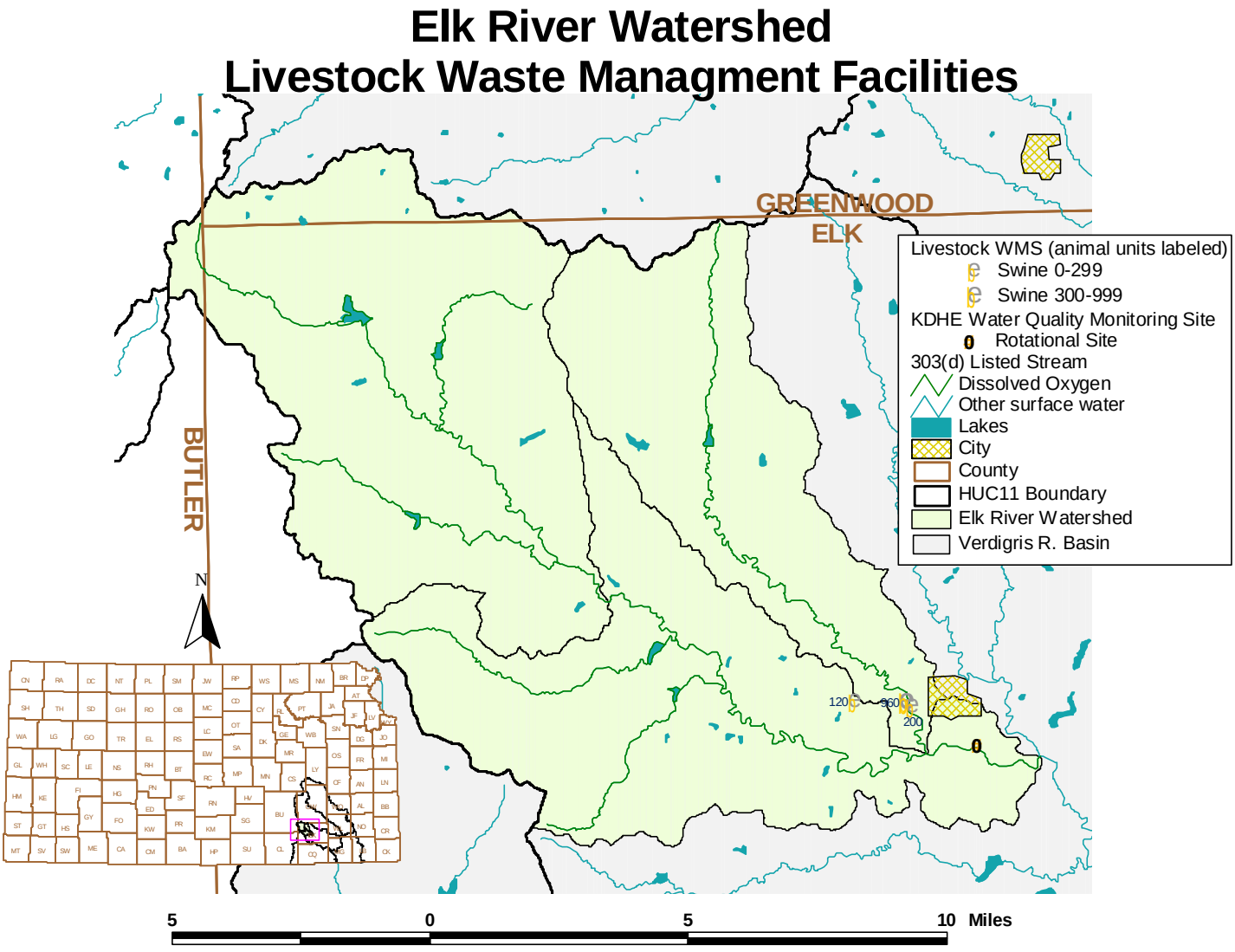

Figure 4

Background Levels: Some organic enrichment may be associated with environmental background levels, including contributions from wildlife and stream side vegetation, but it is likely that the density of animals such as deer is fairly dispersed across the watershed and that the loading of oxygen demanding material is constant along the stream. In the case of wildlife, this loading should result in minimal loading to the streams below the levels necessary to violate the water quality standards. In the case of stream side vegetation, the loading should be greater in the upper half of the watershed or along the main stem with its larger proportion of woodland near the stream.

Elk River Watershed
Land Use, Population and Grazing Density

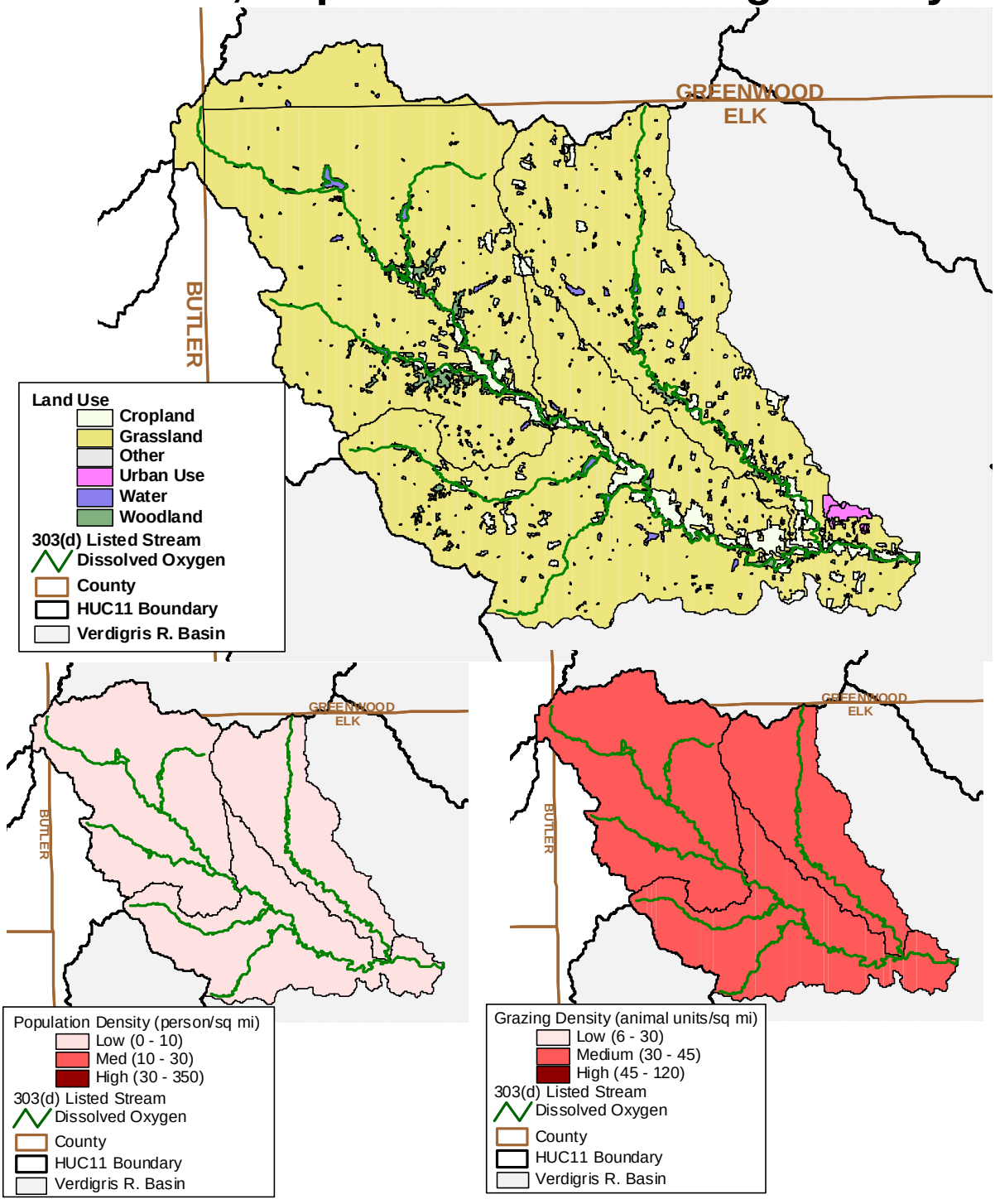

Figure 5

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

BOD is a measure of the amount of oxygen required to stabilize organic matter in a stream. As such, BOD is used as a benchmark measure to anticipate DO levels while it measures the total concentration of DO that will be demanded as organic matter degrades in a stream. It is presumed that reductions in BOD loads will reduce DO excursions under certain critical flow conditions. Therefore, any allocation of wasteloads and loads will be made in terms of BOD reductions. Yet, because DO is a manifestation of multiple factors, the initial pollution load reduction responsibility will be to decrease the BOD over the critical range of flows encountered on the Elk River system. Allocations relate to the BOD levels seen in the Elk River system at site 693 relative to other sites is Southeast Kansas for the critical lower flow conditions (0-3 cfs). Based on this relationship, BOD loads at site 693 need to be reduced so that in stream average BOD is 3.0 mg/L or less. Additional monitoring over time will be needed to further ascertain the relationship between BOD reductions of non-point sources, flow conditions, and DO levels along the stream.

For this phase of the TMDL the average condition is considered across the seasons to establish goals of the endpoint and desired reductions. Therefore, the target average BOD level was multiplied by the average daily flow for the Elk River across all hydrologic conditions. This is represented graphically by the integrated area under the BOD load duration curve established by this TMDL. Any future development of wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate BMPs is expected to eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between physical factors, organic matter and DO.

Point Sources: A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current Wasteload Allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers (**Figure 6**).

Non-Point Sources: Based on the prior assessment of sources, the distribution of excursions from water quality standards at site 693 and the relationship of those excursions to runoff conditions and seasons, non-point sources are seen as a contributing factor to the occasional DO excursions in the watershed.

The samples from the Elk River watershed show there were no DO violations at flows in excess of 3.0 cfs. The Load Allocation assigns responsibility for reducing the in stream BOD levels at site 693 to 3.0 mg/L across the 0.0 - 3.0 cfs range of the critical flow condition (74 - 99% exceedance) and maintaining the in stream BOD levels at site 693 to the historical levels of 4.0 mg/L for flows in excess of 3.0 cfs (which is 90^{th} percentile of BOD samples for flows in the Elk River above 3.0 cfs near Howard)(**Figure 6**). Sediment control practices such as buffer strips and grassed waterways should help reduce the non-point source BOD load under higher flows as well as reduce the oxygen demand exerted by the sediment transported to the stream that may occur during the critical flow period.

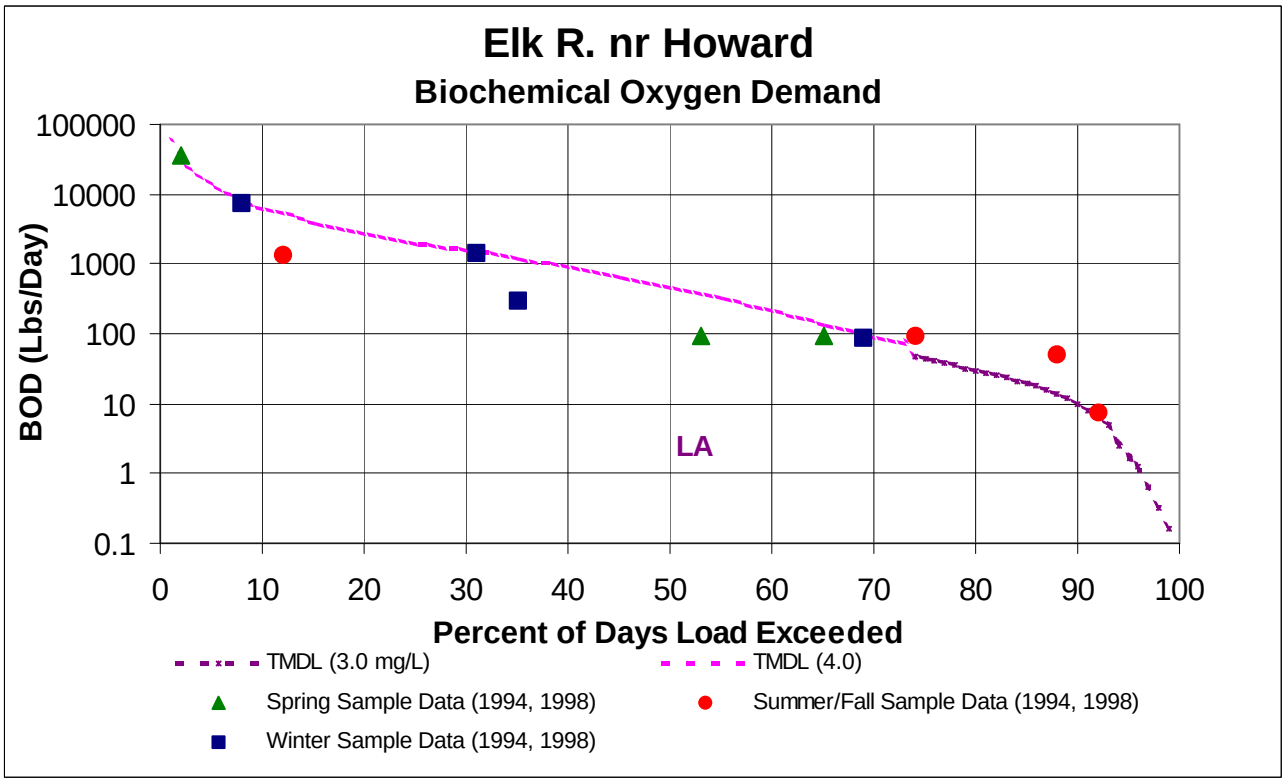

Figure 6

Defined Margin of Safety: The Margin of Safety will be implied based on conservative assumptions used to set the target BOD concentration, since sampling data indicates exceeding this value has seldom led to a dissolved oxygen violation.

State Water Plan Implementation Priority: Because this watershed has indicated some problem with dissolved oxygen which has short term and immediate consequences for aquatic life, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Elk River Basin (HUC 8: 11070104) with a priority ranking of 61 (Low Priority for restoration work).

Priority HUC 11s and Stream Segments: Priority should be directed toward baseflow gaining stream segments along the main stem of the Elk River (12, 14).

5. IMPLEMENTATION

Desired Implementation Activities

1. Where needed, restore riparian vegetation along target stream segments.

2. Install grass buffer strips where needed along streams.
3. Renew state and federal permits and inspect permitted facilities for permit compliance
4. Install proper manure and livestock waste storage.
5. Insure proper on-site waste system operations in proximity to targeted streams.
6. Insure that labeled application rates of chemical fertilizers are being followed.

Implementation Programs Guidance

NPDES and State Permits - KDHE

a. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.

b. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.

c. Manure management plans will be implemented to prevent the introduction of organic material to the stream.

Non-Point Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for pollution reduction from livestock operations in watershed.

b. Provide technical assistance on practices geared to small livestock operations which minimize impact to stream resources.

c. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority stream segments within this TMDL.

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

a. Provide alternative water supplies to small livestock operations

b. Develop improved grazing management plans

c. Reduce grazing density on overstocked pasturelands

d. Install livestock waste management systems for manure storage

e. Implement manure management plans

f. Install replacement of on-site waste systems close to the priority streams.

g. Coordinate with USDA/NRCS Environmental Quality Improvement Program in providing educational, technical and financial assistance to agricultural producers.

Riparian Protection Program - SCC

a. Develop riparian restoration projects along targeted stream segments, especially those areas with baseflow.

b. Design winter feeding areas away from streams.

Buffer Initiative Program - SCC

a. Install grass buffer strips near streams.

b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate livestock producers on riparian and waste management techniques.
b. Educate chemical fertilizer users on proper application rates and timing.
c. Provide technical assistance on livestock waste management design.
d. Continue Section 319 demonstration projects on livestock management.

Agricultural Outreach - KDA

a. Provide information on livestock management to commodity advocacy groups.
b. Support Kansas State outreach efforts.

Local Environmental Protection Program - KDHE

a. Inspect and repair on-site waste systems within 500 feet of priority stream segments.

Timeframe for Implementation: Pollution reduction practices should be installed along the Elk River and base flow gaining tributaries in 2003-2007, with follow up implementation thereafter.

Targeted Participants: Primary participants for implementation will be the identified point sources and landowners immediately adjacent to the priority stream segments. Implemented activities should be targeted to those stream segments with greatest potential contribution to baseflow. Nominally, this would be most likely be:

1. Areas of denuded riparian vegetation along the Elk River and contributing tributaries.
2. Facilities with inadequate water quality controls
3. Unbuffered cropland adjacent to stream
4. Sites where drainage runs through or adjacent livestock areas
5. Sites where livestock have full access to stream and stream is primary water supply
6. Poor riparian sites
7. Failing on-site waste systems

Some inventory of local needs should be conducted in 2003 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Milestone for 2007: The year 2007 marks the mid-point of the ten year implementation window for the watershed. At that point in time, milestones should be reached which will have at least two-thirds of the landowners responsible for riparian restoration or buffer strips, cited in the local assessment, participating in the implementation programs provided by the state. Additionally, sampled data from site 693 should indicate evidence of improved dissolved oxygen levels at the critical flow conditions below 3 cfs relative to the conditions seen over 1994 and 1998.

Delivery Agents: The primary delivery agents for program participation will be the conservation districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State County staff managing. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for primarily Elk county.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

4. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

5. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control non-point source pollution.

6. K.S.A. 82a-901, *et seq*. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

7. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.

8. The *Kansas Water Plan* and the Verdigris Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund, annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and

water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This TMDL is a High Priority consideration.

Effectiveness: Buffer strips are touted as a means to filter sediment before it reaches a stream and riparian restoration projects have been acclaimed as a significant means of stream bank stabilization. The key to effectiveness is participation within a finite subwatershed to direct resources to the activities influencing water quality. The milestones established under this TMDL are intended to gauge the level of participation in those programs implementing this TMDL.

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1994 and 1998, the state may employ more stringent conditions on agricultural producers and urban runoff in the watershed in order to meet the desired endpoints expressed in this TMDL. The state has the authority to impose conditions on activities with a significant potential to pollute the waters of the state under K.S.A. 65-171. If overall water quality conditions in the watershed deteriorate, a Critical Water Quality Management Area may be proposed for the watershed, in response.

6. MONITORING

KDHE will continue to collect bimonthly samples at rotational Station 693 in 2006 and 2010, including dissolved oxygen samples, in order to assess progress and success in implementing this TMDL toward reaching its endpoint. Should impaired status remain, the desired endpoints under this TMDL may be refined and more intensive sampling may need to be conducted under specified low flow conditions over the period 2007-2011. Use of the real time flow data available at the Elk River near Elk Falls stream gaging station can direct these sampling efforts.

Local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2003 in order to support appropriate implementation projects.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Verdigris Basin were held January 23 in Fredonia and March 6, 2002 in Neodesha. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Verdigris Basin.

Public Hearing: A Public Hearing on the TMDLs of the Verdigris Basin was held in Neodesha on June 4, 2002.

Basin Advisory Committee: The Verdigris Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2001, January 23 and March 6, 2002.

Milestone Evaluation: In 2007, evaluation will be made as to the degree of impairment which

has occurred within the watershed and current condition of the Elk River. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The stream will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2007-2011. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2003 which will emphasize implementation of TMDLs. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2003-2007.

Appendix (Elk River DO TMDL)

Table 2

Elk River Watershed (693)			Otter Creek Wtrshd (574)		
Land Use	Acres	% of Total	Land Use	Acres	% of Total
Cropland	4522	5.7	Cropland	4394	5.6
Grassland	72132	90.5	Grassland	69690	89.1
Urban Use	296	0.4	Urban Use	0	0
Water	786	1.0	Water	609	0.8
Woodland	2003	2.5	Woodland	3496	4.5
Total	79739	100	Total	78190	100

Table 3

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		PHFIELD		TEMP_CENT		PHOSPHU		TSS		TURBIDITY		FLOW
	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693
2/9/94	12.4	13.1	0.050	0.050	3.70	3.40	10	10	0.78	0.42	8.0	8.1	0	0	0.050	0.050	13	10	5.1	3.3	4.5
4/13/94	10.3	10.3	0.050	0.050	4.30	3.30	17000	1500	0.28	0.39	8.0	7.9	7	7	0.200	0.070	188	62	128.0	34.0	1580
6/14/94	6.3	6.8	0.050	0.050	2.70	3.20	60	2300	0.58	0.29	7.8	8.0	23	23	0.050	0.050	10	22	7.0	8.0	6.2
8/10/94	**4.6**	7.6	0.019	0.010	5.60	9.40	1100	400	0.01	0.11	7.6	8.0	23	23	0.059	0.080	28	34	11.0	9.0	3
10/12/94	**4.8**	5.8	0.010	0.010	3.50	3.30	270	500	0.01	0.01	7.6	7.8	12	12	0.010	0.010	19	17	7.0	7.0	0.4
12/7/94	10.8	10.5	0.080	0.060	3.90	3.90	260	40	0.65	0.40	8.0	7.9	4	2	0.030	0.010	19	9	12.0	4.0	68
2/4/98	12.1	11.7	0.020	0.020	1.05	1.08	20	20	0.36	0.17	8.1	8.1	4	4	0.010	0.010	7	7	3.8	3.4	54
6/3/98	8.0	7.9	0.020	0.020	1.00	1.32	160	230	0.53	0.24	7.9	7.9	27	26	0.040	0.050	17	20	8.3	9.0	17
8/5/98	7.7	4.9	0.100	0.030	11.43	1.77	60	1300	0.53	0.39	7.9	7.7	27	25	0.230	0.100	25	46	10.0	32.0	0.82
10/7/98	8.3	7.8	0.020	0.020	1.00	1.26	260	390	0.37	0.34	7.9	7.9	18	17	0.062	0.067	34	34	26.0	21.0	247
12/9/98	10.8	11.0	0.020	0.020	3.93	3.90	3200	2100	0.31	0.39	8.0	7.8	8	8	0.060	0.050	33	15	24.0	9.0	350
Avg	8.7	7.9	0.040	0.023	4.34	2.06	920	1005	0.44	0.34	7.9	7.8	20	19	0.098	0.067	27	29	17.08	17.75	153.7

Table 4

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		PHFIELD		TEMP_CENT		PHOSPHU		TSS		TURBIDITY		FLOW
	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693	574	693
8/10/94	**4.6**	7.6	0.019	0.010	5.60	9.40	1100	400	0.01	0.11	7.6	8.0	23	23	0.059	0.080	28	34	11.0	9.0	3
10/12/94	**4.8**	5.8	0.010	0.010	3.50	3.30	270	500	0.01	0.01	7.6	7.8	12	12	0.010	0.010	19	17	7.0	7.0	0.4
Avg	4.7	6.7	0.015	0.010	4.55	6.35	685	450	0.01	0.06	7.6	7.9	18	18	0.035	0.045	24	26	9.00	8.00	1.7